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(54) **FLUID RETRIEVAL USING ANNULAR CLEANING SYSTEM**

(71) Applicant: **Adam Larsen**, Spring, TX (US)

(72) Inventor: **Adam Larsen**, Spring, TX (US)

(73) Assignee: **BAKER HUGHES OILFIELD OPERATIONS LLC**, Houston, TX (US)

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CPC ***E21B 43/18*** (2013.01); ***E21B 33/12*** (2013.01)

(58) **Field of Classification Search**
CPC E21B 43/18; E21B 33/12
See application file for complete search history.

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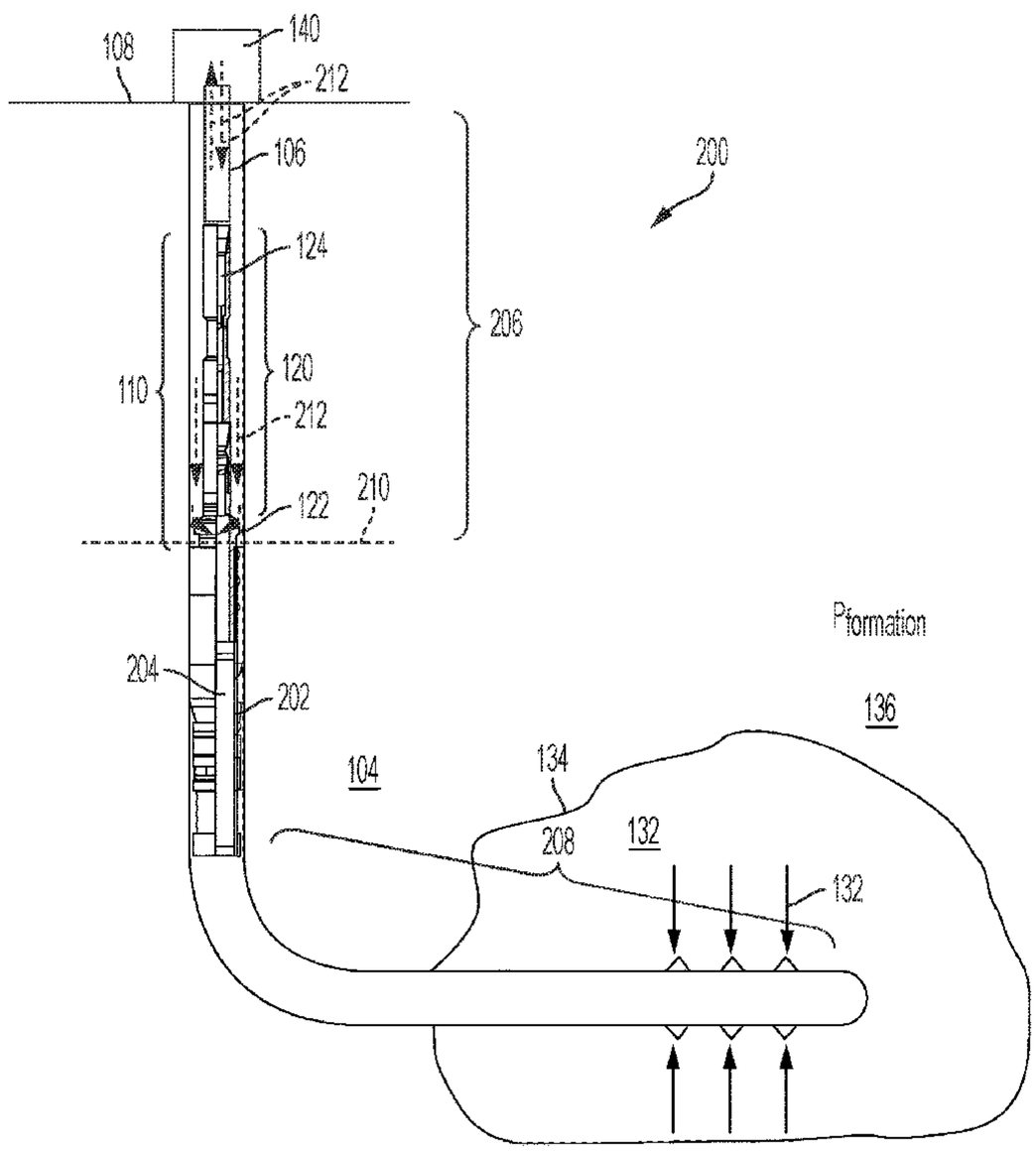
Primary Examiner — Catherine Loikith
(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(57) **ABSTRACT**

A method of drawing a fluid into a wellbore from a formation. The wellbore is separated into a first section and a second section via an annulus closure device, the annulus closure device having a passage therethrough. A pump at a surface location, circulates a circulation fluid in the first section to reduce a pressure in the second section. Reducing the pressure in the second section draws the fluid from the formation into the second section.

14 Claims, 3 Drawing Sheets



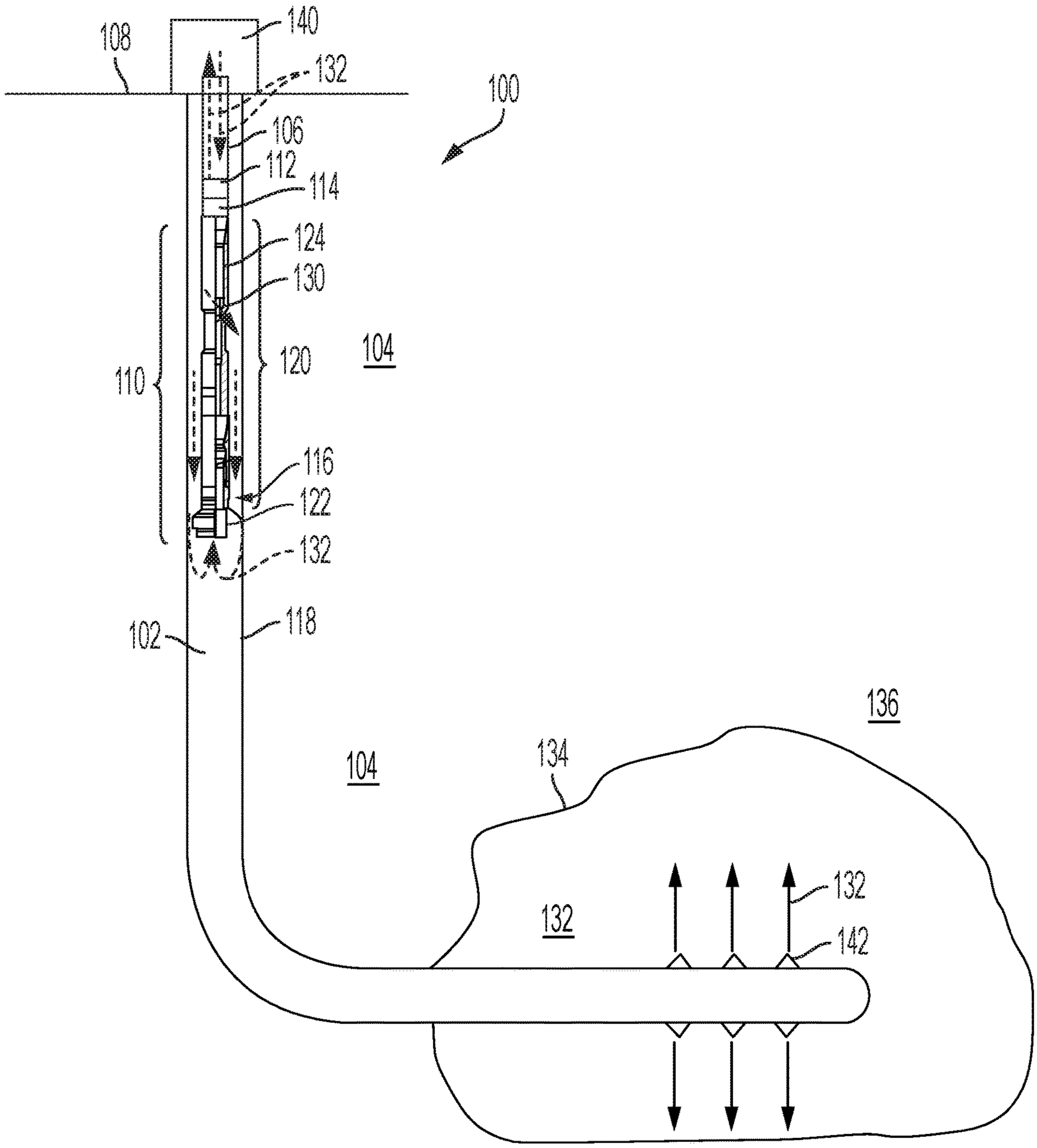

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FIG. 1

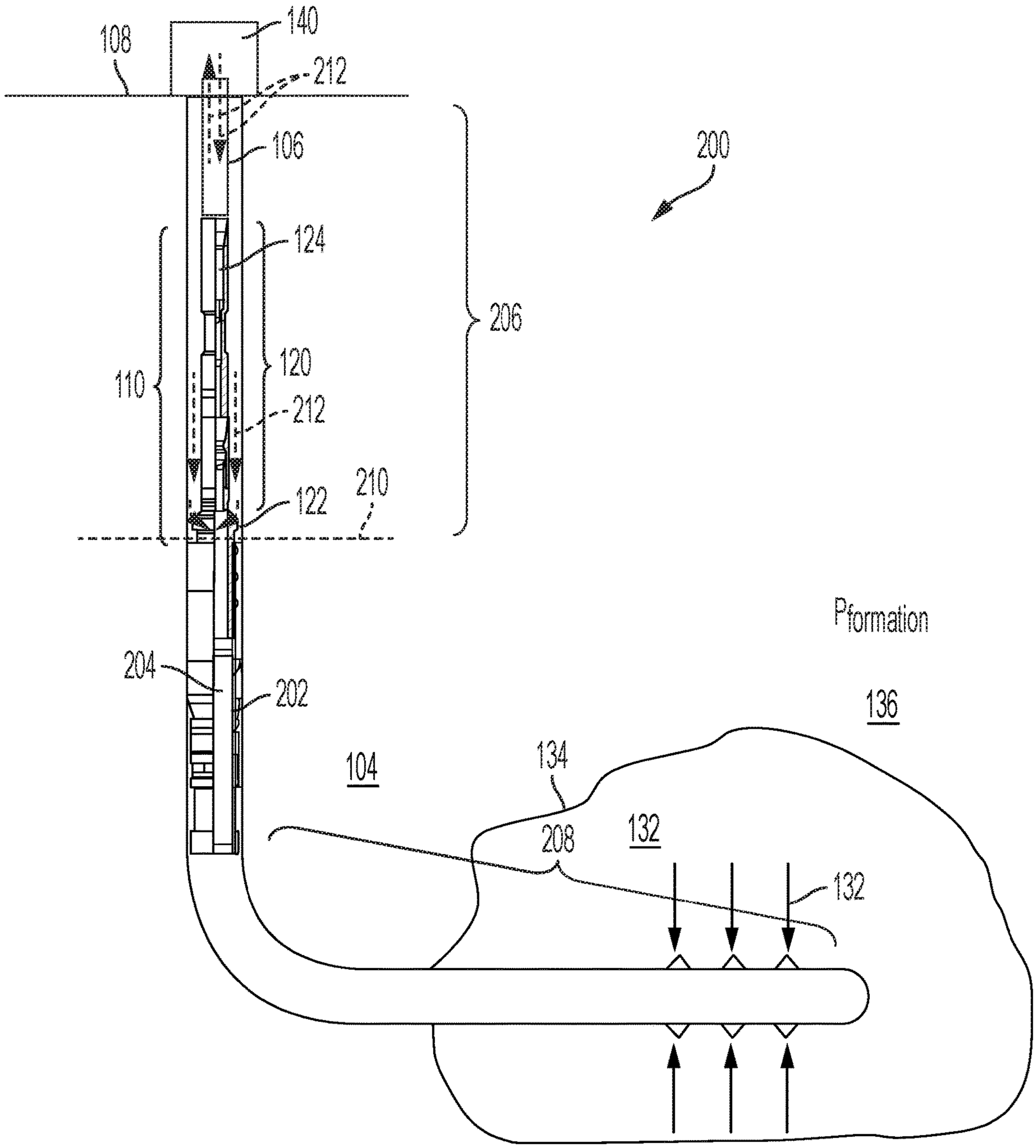
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FIG. 2

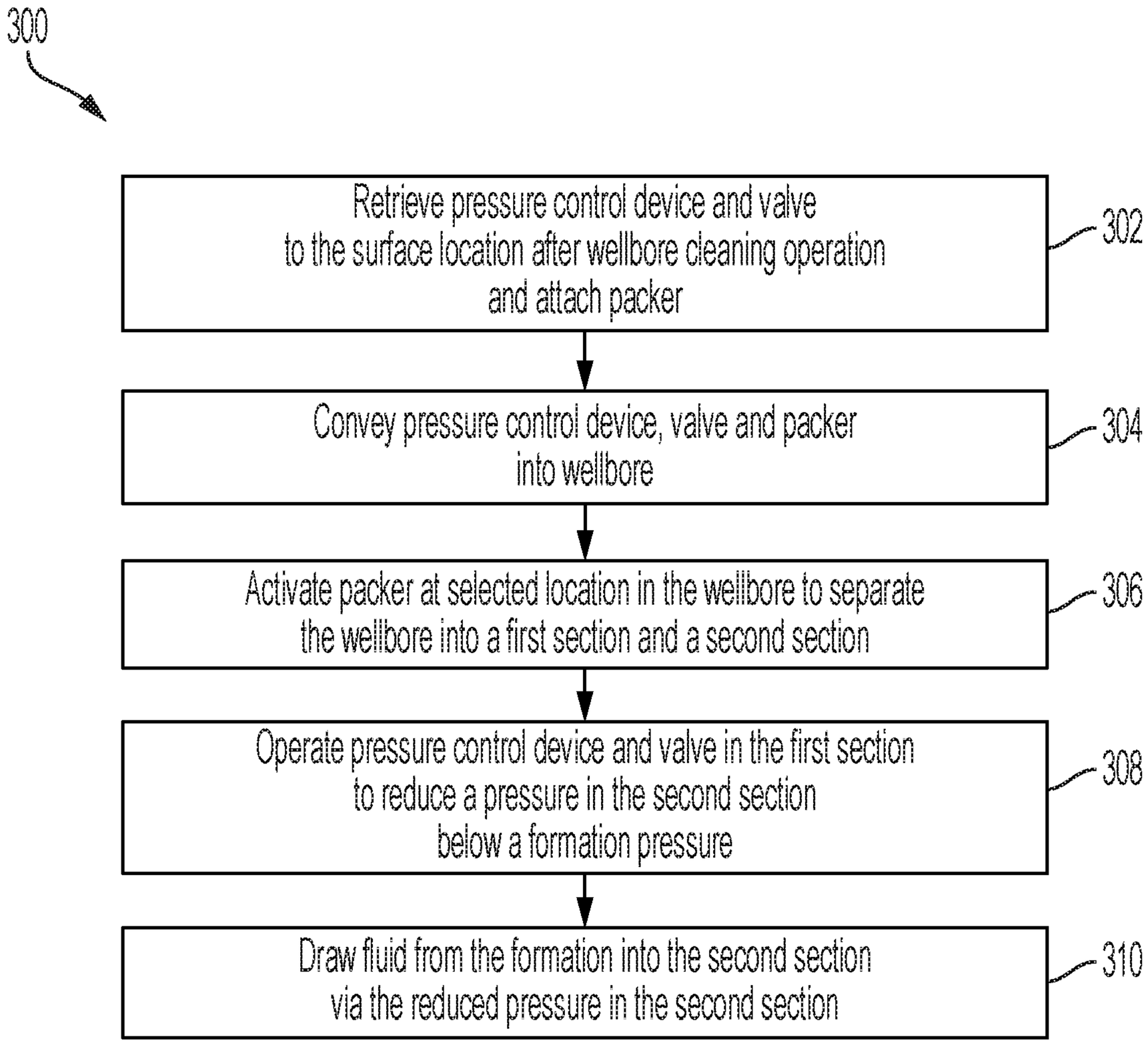
300
Retrieve pressure control device and valve to the surface location after wellbore cleaning operation and attach packer
302
Convey pressure control device, valve and packer into wellbore
304
Activate packer at selected location in the wellbore to separate the wellbore into a first section and a second section
306
Operate pressure control device and valve in the first section to reduce a pressure in the second section below a formation pressure
308
Draw fluid from the formation into the second section via the reduced pressure in the second section
310

FIG. 3

FLUID RETRIEVAL USING ANNULAR CLEANING SYSTEM

BACKGROUND

In the resource recovery industry, debris tends to accumulate in a wellbore during drilling operations. A wellbore cleaning operation can be used to clear the debris from the wellbore by circulating cleaning fluid through the wellbore in order to draw the debris into a container. One result of this operation is that cleaning fluid flows into the formation surrounding the wellbore, displacing formation fluids away from the wellbore. These cleaning fluids must then be removed from the wellbore in order to reach the formation fluid. Current methods of removing the cleaning fluid from the formation are time-consuming and costly. Therefore, there is a need to remove cleaning fluid from the formation in a timely manner after a cleaning operation is performed on a wellbore.

SUMMARY

A method of drawing a fluid into a wellbore from a formation, comprising separating the wellbore into a first section and a second section via an annulus closure device, the annulus closure device having a passage therethrough; and circulating a circulation fluid, via a pump at a surface location, in the first section to reduce a pressure in the second section, wherein reducing the pressure in the second section draws the fluid from the formation into the second section.

A system for drawing fluid from a formation, comprising an annulus closure device for separating a wellbore penetrating the formation into a first section and a second section; a passage extending through the annulus closure device to provide fluid communication between the first section and the second section; and a pump at a surface location for circulating a circulation fluid in the first section to reduce a pressure in the second section to draw the fluid from the formation into the second section

BRIEF DESCRIPTION OF THE DRAWINGS

The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

FIG. **1** discloses a wellbore cleaning system disposed in a wellbore.

FIG. **2** shows a wellbore restoration system for drawing fluids back into the wellbore from the formation after completion of the wellbore cleaning process of FIG. **1**; and

FIG. **3** shows a flow chart illustrating an operation for retrieving cleaning fluid from a formation after a wellbore cleaning operation.

DETAILED DESCRIPTION

A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

Referring to FIG. **1**, a wellbore cleaning system **100** is disclosed in a wellbore **102** in a formation **104**. In one embodiment, the wellbore cleaning system **100** is a Vectored Annular Cleaning System (VACS™) of Baker Hughes, a GE company. The wellbore cleaning system **100** includes a work string **106** extending from a surface location **108** to a downhole location and a pressure control device **110** at a downhole end of the work string **106**. In one embodiment, the work string **106** includes a first threaded pipe **112** at its bottom end or downhole end and the pressure control device **110** includes a second threaded pipe **114** at its top end or uphole end. The pressure control device **110** is coupled to the work string **106** by threadingly attaching the first threaded pipe **112** to the second threaded pipe **114**. The pressure control device **110** has an outer diameter less than that of the wellbore **102**, thereby allowing for the existence of an annulus **116** between the pressure control device **110** and a wall **118** of the wellbore **102**.

In one embodiment, the pressure control device **110** includes a fluid circulation device **120** and a valve **122** attached at a bottom end of the fluid circulation device **120**. In various embodiments, the valve **122** can be a bottom float valve, a flapper valve or other such valve that allows flow fluid in only one direction. A flow tube **124** runs from one end of the fluid circulation device **120** to an opposite end and attaches to the work string **106** at a top end of the fluid circulation device **120**, allowing fluid communication from the downhole location to the surface location **108** via the work string **106**. The fluid circulation device **120** also includes a jet **130** for directing fluid from an interior of the work string **106** to the annulus **116**.

To clean the wellbore **102**, a pump **140** at the surface location **108** circulates a cleaning fluid **132** downhole through the work string **106** from the surface location **108** to the pressure control device **110**. The cleaning fluid **132** is then directed from inside the fluid circulation device **120** into the annulus **116** via jet **130**. The cleaning fluid **132** circulates downhole through the annulus **116**, picking up debris along the way. The valve **122** at the bottom end of the fluid circulation device **120** provides a one-way circulation of fluid into the fluid circulation device **120** in an uphole direction. Cleaning fluid **132** entering the bottom end of the fluid circulation device **120** passes through the fluid circulation device **120**, flow tube **124** and work string **106** to return to the surface location. A portion of the cleaning fluid **132** in the fluid circulation device is recirculated in the annulus via the jet **130**, down through the annulus **116**, into the fluid circulation device **120** via the valve **122**, and uphole within the flow tube **124**. Debris that enters the fluid circulation device **120** along with the cleaning fluid **132** at the valve **122** is diverted to a debris trap (not shown) in the fluid circulation device **120**, thereby cleaning the wellbore.

During the cleaning process, the pressure control device **110** can be moved within the wellbore **102** in order to clean several locations of the wellbore **102**, including the horizontal portion shown in FIG. **1**. The pressure of the cleaning fluid **132** in the annulus **116** during the cleaning process is greater than a formation pressure in the formation **104**, causing the cleaning fluid **132** to migrate into the formation **104**, especially at porous locations in the wellbore **102**, such as at perforations **142**. The pressure of the cleaning fluid **132** thereby pushes a boundary **134** between the cleaning fluid **132** and the formation fluid **136** away from the wellbore **102**.

FIG. **2** shows a wellbore restoration system **200** for drawing fluids back into the wellbore **102** from the formation **104** after completion of the wellbore cleaning process of FIG. **1**. The wellbore restoration system **200** includes the work string **106** and pressure control device **110** of FIG. **1** as well as an annulus closure device, such as packer **202** mechanically coupled to a bottom end of the pressure control device **110**. The packer **202** is appended at a downhole end of the valve **122**. A passage **204** or conduit extends through the packer **202** and allows fluid to flow from one end

of the packer **202** to another end. The passage **204** is in fluid communication with the flow tube **124** of the pressure control device **110**. As discussed below a pressure generated in the flow tube **124** is also generated in the second section **208** via the passage **204**. Also, fluid retrieved from the formation **104** into the second section **208** flows to the surface location via the passage **204**, flow tube **124** and work string **106**.

To draw cleaning fluid **132** back into the wellbore **102**, the wellbore restoration system **200** is lowered down into the wellbore **102**. The packer **202** is activated at a selected location **210** in the wellbore to close of the wellbore **102** at the selected location **210**, thereby separating the wellbore **102** into a first section **206** and a second section **208**. For purposes of illustration, the first section **206** is an uphole section that extends to the surface location **108** and the second section **208** is an isolated downhole section created by actuating the packer **202**. The work string **106** and pressure control device **110** are disposed in the first section **206**.

The pressure control device **110** is operated to circulate a circulation fluid **212** through the first section **206** of the wellbore in a circulation pattern similar to the circulation pattern described with respect to FIG. **1**. In particular, the pump **140** at the surface location pumps a circulation fluid **212** down through the work string **106** and out of the pressure control device **110** (i.e., the fluid circulation device **120**) and into the annulus **116**. The circulation fluid **212** then circulates downhole through the annulus **116** and back into the pressure control device **110** at the bottom of the fluid circulation device **120**. The circulation fluid **212** is the sent uphole to the surface via the flow tube **124** and work string **106**. This circulation pattern reduces a pressure in the flow tube **124** of the pressure control device **110**, thereby reducing a pressure P_2 in the second section **208**. By continued circulation of the circulation fluid in the first section **206**, the pressure P_2 in the second section **208** can be reduced to a value less than the formation pressure $P_{formation}$, thereby causing the cleaning fluid **132** residing in the formation **104** to be forced back into the second section **208**. The cleaning fluid **132** retrieved from the formation is then forced up through the passage **204** in the packer **202** and to the surface via flow tube **124** and work string **106**.

As the cleaning fluid **132** residing in the formation **104** is retrieved into the second section **208**, the formation fluid **136** previously displaced by the cleaning fluid **132** is drawn toward the second section and eventually into the second section **208**. It is understood that although the wellbore restoration system **200** is discussed as retrieving cleaning fluid from a formation, the fluid can be any type of fluid, including cleaning fluid, formation fluid, etc.

FIG. **3** shows a flow chart **300** illustrating an operation for retrieving cleaning fluid from a formation after a wellbore cleaning operation. In box **302**, the fluid circulation device **120** and valve **122** of the wellbore cleaning system **100** are retrieved to the surface and the packer **202** is appended at a downhole end of the valve **122**, thereby forming the wellbore restoration system **200**. In box **304**, the wellbore restoration system **200** is lowered into the wellbore. In box **306**, the packer **202** is activated at a selected location in the wellbore **102** to separate the wellbore **102** into a first section **206** and a second section **208**. In box **308**, the wellbore restoration system is operated in the first section **206** to thereby reduce a pressure in the second section **208**. In box **310**, the cleaning fluid in the formation **104** is drawn into the second section **208** of the wellbore, through the passage **204** in the packer **202** and uphole via the flow tube **124** and work string **106**.

Set Forth Below are Some Embodiments of the Foregoing Disclosure

Embodiment 1

A method of drawing a fluid into a wellbore from a formation, including separating the wellbore into a first section and a second section via an annulus closure device, the annulus closure device having a passage therethrough; and circulating a circulation fluid, via a pump at a surface location, in the first section to reduce a pressure in the second section, wherein reducing the pressure in the second section draws the fluid from the formation into the second section.

Embodiment 2

The method of any prior embodiment, further indicating circulating the circulation fluid in the first section via the pump at the surface location and a fluid circulation device in the first section to reduce a pressure in a flow tube coupled to the passage in the annulus closure device, thereby reducing the pressure in the second section via fluid communication between the flow tube and the passage through the annulus closure device.

Embodiment 3

The method of any prior embodiment, further indicating drawing the fluid from the second section to the surface location via the passage in the annulus closure device and the flow tube.

Embodiment 4

The method of any prior embodiment, wherein the fluid circulation device creates a fluid circulation pattern that draws the fluid from the second section.

Embodiment 5

The method of any prior embodiment, further indicating reducing the pressure in the second section below a formation pressure to draw the fluid into the second section.

Embodiment 6

The method of any prior embodiment, wherein the annulus closure device is a packer coupled to a downhole end of the fluid circulation device.

Embodiment 7

The method of any prior embodiment, wherein the first section is uphole of the second section.

Embodiment 8

The method of any prior embodiment, further indicating removing the fluid circulation device from the wellbore after a wellbore cleaning operation, attaching the annulus closure device to the fluid circulation device and lowering the fluid circulation device and the annulus closure device into the

wellbore in order to separate the wellbore into the first section and the second section.

Embodiment 9

A system for drawing fluid from a formation, indicating an annulus closure device for separating a wellbore penetrating the formation into a first section and a second section; a passage extending through the annulus closure device to provide fluid communication between the first section and the second section; and a pump at a surface location for circulating a circulation fluid in the first section to reduce a pressure in the second section to draw the fluid from the formation into the second section.

Embodiment 10

The system of any prior embodiment, further indicating a fluid circulation device in the first section that circulates the circulation fluid in the first section to reduce a pressure in a flow tube in the first section, thereby reducing the pressure in the second section via fluid communication between the flow tube and the passage through the annulus closure device.

Embodiment 11

The system of any prior embodiment, wherein the fluid from the second section is drawn to the surface location via the passage in the annulus closure device and the flow tube.

Embodiment 12

The system of any prior embodiment, wherein the fluid circulation device creates a fluid circulation pattern that draws the fluid from the second section.

Embodiment 13

The system of any prior embodiment, wherein the pump circulates the circulation fluid in the first section to reduce the pressure in the second section below a formation pressure to draw the fluid into the second section.

Embodiment 14

The system of any prior embodiment, wherein the annulus closure device is a packer coupled to a downhole end of the fluid circulation device.

Embodiment 15

The system of any prior embodiment, wherein the first section is uphole of the second section.

The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Further, it should be noted that the terms "first," "second," and the like herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another. The modifier "about" used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (e.g., it includes the degree of error associated with measurement of the particular quantity).

The teachings of the present disclosure may be used in a variety of well operations. These operations may involve using one or more treatment agents to treat a formation, the fluids resident in a formation, a wellbore, and/or equipment in the wellbore, such as production tubing. The treatment agents may be in the form of liquids, gases, solids, semi-solids, and mixtures thereof. Illustrative treatment agents include, but are not limited to, fracturing fluids, acids, steam, water, brine, anti-corrosion agents, cement, permeability modifiers, drilling muds, emulsifiers, demulsifiers, tracers, flow improvers etc. Illustrative well operations include, but are not limited to, hydraulic fracturing, stimulation, tracer injection, cleaning, acidizing, steam injection, water flooding, cementing, etc.

While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the claims. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited.

What is claimed is:

1. A method of drawing a fluid into a wellbore from a formation, comprising:

separating the wellbore into a first section and a second section via an annulus closure device, the annulus closure device having a passage therethrough; and

circulating a circulation fluid in the first section via a fluid circulation device in the first section to reduce a pressure in the second section, to draw the fluid from the formation into the second section wherein the fluid circulation device defines an annulus between the fluid circulation device and a wall of the wellbore and includes a flow tube, a jet and a valve that provides one-way circulation from the annulus into the fluid circulation device, and wherein circulating the circulation fluid in the first section includes directing the circulation fluid from inside the fluid circulation device into the annulus via the jet, flowing the circulation fluid downhole through the annulus, into the fluid circulation tube via the valve, and uphole through the flow tube.

2. The method of claim **1**, further comprising pumping the circulation fluid via a pump at a surface location to the fluid circulation device to circulate the circulation fluid in the first section to reduce the pressure in the flow tube.

3. The method of claim **2**, wherein the flow tube is coupled to the passage, further comprising drawing the fluid from the second section to the surface location via the passage and the flow tube.

4. The method of claim **1**, further comprising reducing the pressure in the second section below a formation pressure to draw the fluid into the second section.

5. The method of claim **1**, wherein the annulus closure device is a packer coupled to a downhole end of the fluid circulation device.

6. The method of claim 1, wherein the first section is uphole of the second section.

7. The method of claim 1, further comprising removing the fluid circulation device from the wellbore after a wellbore cleaning operation, attaching the annulus closure device to the fluid circulation device, lowering the fluid circulation device and the annulus closure device into the wellbore, and activating the annulus closure device in order to separate the wellbore into the first section and the second section.

8. A system for drawing fluid from a formation, comprising:

a string comprising a fluid circulation device and an annulus closure device at an end of the fluid circulation device for separating a wellbore penetrating the formation into a first section and a second section, the fluid circulation device defining an annulus between the fluid circulation device and a wall of the wellbore, the fluid circulation device including:

a flow tube,

a jet that directs a circulation fluid from inside the fluid circulation device into the annulus, and

a valve that provides one way circulation from the annulus into the fluid circulation device, wherein fluid circulates downhole in the annulus from the jet to the valve and circulates uphole from the valve through the flow tube to reduce a pressure in the second section to draw the fluid from the formation into the second section; and

a passage extending through the annulus closure device to provide fluid communication between the first section and the second section.

9. The system of claim 8, wherein the fluid circulation device includes the flow tube in fluid communication with the passage through the annulus closure device.

10. The system of claim 9, wherein the annulus closure device is a packer coupled to a downhole end of the fluid circulation device.

11. The system of claim 8, wherein the first section is uphole of the second section.

12. The system of claim 8, further comprising a pump at a surface location for circulating the circulation fluid in the first section.

13. The system of claim 12, wherein the fluid from the second section is drawn to the surface location via the passage in the annulus closure device and the flow tube.

14. The system of claim 12, wherein the pump circulates the circulation fluid from the surface location into the first section to reduce the pressure in the flow tube.

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